The Commonwealth of Massachusetts

Office of Public Safety & Inspections Board

of Building Regulations and Standards

1000 Washington Street, Suite 710

Boston, MA 02118

780 CMR - MASSACHUSETTS BUILDING CODE - AMENDMENT PROPOSAL FORM

Code (Indicate with an 'x')	X_ Ninth Edition Base _ Ninth Edition One- and Two-Family Dwellings	*State Use Only*	
Date:	November 5, 2020	**Date Received:**	11-6-2020
Code Section:	AA104 and IECC Chapter 5	**Code Change Number:**	11-04-2020
Name and company affiliation if any: Mike Turns, PSD (on behalf of the Massachusetts Program Administrators)			
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Indicate with an 'x' the type of amendment proposed:

X Change Section X Add new section X Delete section and substitute _Delete section; no substitute

___Other, Explain:

Please type below the proposed amendment. If you propose to change a section, please copy the original text from the appropriate 2015 I-code and\or Massachusetts amendment. Indicate with strike out the text you propose to delete and add new text in either *italic* or red font. Also you please provide justification of your proposal as a second page and include information on the **Introduction and Background** of your proposal, **Pro *and* Con Reasons for Adoption** of it, a summary of estimated **Costs for Building Owners**, and **Life Safety Benefits** for building occupants. Also, please indicate whether or not the proposal has been presented to the International Code Council (ICC) for consideration. If not, please explain why the proposal is unique to Massachusetts. When complete email this file to Cesar.Lastra@state.ma.us. Please use additional pages if necessary.

Please see attachment

Introduction and Background:

Pro *and* Con Reasons for Adoption: Pros: Cons:

Costs to Building Owners:

Life Safety Benefits:

Massachusetts Building Code Change Proposal: "Additions and Alterations (Triple A) Stretch Code"

Part 2: Commercial construction

This code change proposal is offered on behalf of Mass Save, a collaboration of Massachusetts' natural gas and electric utilities and energy efficiency service providers including Berkshire Gas, Blackstone Gas Company, Cape Light Compact, Eversource, Liberty Utilities, National Grid and Unitil.

Introduction and Background:

Currently, the stretch code does not apply to additions or alterations as Section AA refers to the Existing Buildings chapter just like non-stretch communities. Thus, the efficiency requirements for additions and alterations in stretch code communities are not a stretch at all. Given the high volume of these projects, there is a significant energy savings opportunity for the Commonwealth to add requirements for these project types in the stretch code.

This proposal would improve the energy efficiency of commercial buildings undergoing additions or alterations in stretch code communities. The proposed modifications below integrate directly with the structure of Chapter 5 of the IECC Commercial Provisions. The three main code sections are:

- C502 Additions
- C503 Alterations, and
- (new) C506 Extensive Alterations.

The elements of this proposal have been vetted and demonstrated to be cost effective. For instance, the building thermal envelope R-values and U-factors and provisions for lighting and mechanical systems in this proposal have all been taken from either the 2021 IECC or NYStretch (the stretch code of New York State)

For Climate Zone 5A, a NYSERDA study[1] determined that NYStretch would on average save new commercial building owners $0.19 per square foot per year (10.5%) compared to ASHRAE 90.1-2016, with a simple payback of 9.8 years.

Pro and Con Reasons for Adoption:

Pros: Energy bill savings for commercial building owners and tenants, increased comfort for building occupans, and reduced carbon footprint statewide.

Cons: Small increased cost of construction, but these are likely to be offset by building owner savings.

Costs to Building Owners:

Small increased cost of construction (likely to be offset by building owner savings)

[1] 2020 NYStretch Energy Code Commercial Cost Effectiveness

Life Safety Benefits:

None

Note: The amendments mentioned in AA104.1 are addressed in a separate code change proposal.

Amendment to R202

R202 Definitions

Add definition:

EXTENSIVE ALTERATION. Any alteration where the total work area exceeds 75 percent of the building or dwelling unit. Work areas in which the alteration work is exclusively plumbing, mechanical or electrical shall not be included in the computation of the total area of all work areas.

Amendment to Stretch Code AA104

AA104 Replace the section with the following:

AA104 Existing Buildings

For alterations, renovations, and additions of existing buildings in these municipalities, the energy efficiency requirements of ~~780 CMR 13.00: Energy Efficiency or Chapter 11 of 780 CMR 51.00 shall be used as applicable~~ AA104.1 through AA104.3 shall be met as applicable based on the use and occupancy of the building.

AA104.1 Existing Low-Rise Residential Buildings

Additions, alterations, repairs, and changes of occupancy or use in all one- and two-family dwellings and multiple single-family dwellings (townhouses), as well as Groups R-2, R-3, and R-4 of four stories or less above grade plane, shall comply with 780 CMR 51.00 Chapter 11 Sections R501 through R505 as amended below, and Sections 506 and 507.

AA104.2 Existing Commercial Buildings

Additions, alterations, repairs, and changes of occupancy or use in all non-residential and R-use buildings of more than four stories shall comply with 780 CMR 51.00 Chapter 11 Sections C501 through C505 as amended below.

AA104.3 Existing Large Area and High Energy Use Buildings: Reserved

C502.1 Revise section as follows

C502.1 General

Additions shall comply with Section C402, C403, C404, C405, C406, and C502.2. Additions complying with Section C402.1.6 shall achieve 10 percent better than code.

C502.2 Revise section as follows:

C502.2 Prescriptive Compliance

Additions shall comply with sections C502.2.1 through C502.2.6.2, where Table C402.1.3 is replaced by Table C502.1.1, Table C402.1.4 is replaced by Table C502.1.2, and Table C402.4 is replaced with Table C502.1.3.

Table C502.1.1 Opaque Thermal Envelope Insulation Component Minimum Requirements, R-Value Method[a,h]

CLIMATE ZONE	All other	Group R
Roofs		
Insulation Entirely above roof deck	R-33ci	R-33ci
Metal buildings[b]	R-19 + R-11 LS	R-19 + R-11 LS
Attic and other	R-53	R-53
Walls, above grade		
Mass[f]	R-13.3ci	R-15.2ci
Metal building	R-13 + R-19.5ci	R-13 + R-19.5ci
Metal framed	R-13 + R-11ci	R-13 + R-11ci
Wood framed and other	R-13 + R-9ci or R-19 + R-5ci	R-13 + R-9ci or R-19 + R-5ci
Walls, below grade		
Below-grade wall[c]	R-7.5ci	R-10ci
Floors		
Mass[d]	R-15ci	R-16.7ci
Joist/framing	R-30[e]	R-30[e]
Slab-on-grade floors		
Unheated slabs	R-15 for 24" below	R-15 for 24" below
Heated slabs[g]	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab
Opaque doors		

Non-Swinging	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/ m^2, 1 pound per cubic foot = 16 kg/m^3. ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.

c. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

d. "Mass floors" shall be in accordance with Section C402.2.3.

e. Steel floor joist systems shall be insulated to R-38.

f. "Mass walls" shall be in accordance with Section C402.2.2.

g. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.

h. Not applicable to garage doors. See Table C402.1.4.

Table C502.1.2

Opaque Thermal Envelope Assembly Maximum Requirements, U-Factor Method

	All other	**Group R**
Roofs		
Insulation Entirely above roof deck	U-0.030	U-0.030
Metal buildings	U-0.035	U-0.035
Attic and other	U-0.020	U-0.020
Walls		
Mass[e]	U-0.086	U-0.076
Metal building	U-0.048	U-0.048
Metal framed	U-0.052	U-0.052
Wood framed and other[c]	U-0.048	U-0.048
Below-grade wall[c]	C-0.119	C-0.092
Floors		
Mass[d]	U-0.057	U-0.051
Joist/framing	U-0.033	U-0.033
Slab-on-grade floors		
Unheated slabs	F-0.52	F-0.51
Heated slabs	F-0.63	F-0.63
Opaque doors		
Swinging	U-0.37	U-0.37
Garage door <14% glazing	U-0.31	U-0.31

a. For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m2, 1 pound per cubic foot = 16 kg/m3. ci = Continuous insulation, NR = No Requirement, LS = Liner System.

b. Where assembly U-factors, C-factors, and F-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system

on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.

c. Where U-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The R-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.

d. Where heated slabs are below grade, below-grade walls shall comply with the U-factor requirements for above-grade mass walls.

e. “Mass floors” shall be in accordance with Section C402.2.3. “Mass walls” shall be in accordance with Section C402.2.2.

Table C502.1.3

Replacement Fenestration Maximum U-factor and SHGC Requirements

Vertical fenestration	
U-factor	
Fixed fenestration	0.36
Operable fenestration	0.43
All other vertical fenestration	
All fenestration	0.27
Entrance doors	0.77
SHGC	
PF < 0.2	0.38
0.2 ≤ PF < 0.5	0.46
PF ≥ 0.5	0.61
Skylights	
U-factor	0.48
SHGC	0.38

PF = Projection Factor

a. U-factor and SHGC are rated in accordance with NFRC 100

C502.2.8 Add section as follows:

C502.2.8 Thermal resistance of mechanical equipment penetrations (Mandatory)

When the total area of penetrations from mechanical equipment listed in Table C403.2.3(3) exceeds 1 percent of the opaque above-grade wall area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default U-factor of 0.5.

Exception: Where mechanical equipment has been tested in accordance with testing standards approved by the authority having jurisdiction, the mechanical

equipment penetration area may be calculated as a separate wall assembly with the U-factor as determined by such test.

C502.2.9 Add section as follows:

C502.2.9 Continuous Insulation (Mandatory)

Structural elements of balconies and parapets that penetrate the building thermal envelope, shall comply with one of the following:

1. Structural elements penetrating the building thermal envelope shall be insulated with continuous insulation having a minimum thermal resistance of R-3.
2. Structural elements of penetrations of the building thermal envelope shall incorporate a minimum R-3 thermal break where the structural element penetrates the building thermal envelope.

C502.2.10 Add section as follows:

C502.2.10 Air leakage--thermal envelope (Mandatory).

Additions not less than 25,000 square feet and not greater than 50,000 square feet, and less than or equal to 75 feet in height, shall show compliance through testing in accordance with Section C402.5.9. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the code official and the building owner.

C502.2.3.1 Add section as follows:

C502.2.3.1 Energy Recovery Ventilation Systems (Mandatory)

Ventilation systems shall comply with C403.7.4, except that exception 8 is replaced with the following:

Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design ventilation outdoor air flow rate. Multiple exhaust fans or outlets located within a 30-foot radius from the outdoor air supply unit shall be considered a single exhaust location.

C502.2.3.2 Add section as follows:

C502.2.3.2 Allowable fan horsepower (Mandatory).

Mechanical systems shall comply with Section C403.8.1, where Table C403.8.1(1) is replaced with Table C502.2.3.2, and with an added exception for fans supplying air to active chilled beams.

Table C502.2.3.2 Fan Power Limitation

	Limit	Constant volume	Variable volume
Option 1: Fan system motor nameplate hp	Allowable nameplate motor hp	$hp \leq CFM_s * 0.0009$	$hp \leq CFM_s * 0.0011$

Option 2: Fan system bhp	Allowable fan system bhp	$bhp \leq CFM_S \times 0.00088 + A$	$bhp \leq CFM_S \times 0.0010 + A$

For SI: 1 bhp = 735.5 W, 1 hp = 745.5 W, 1 cfm = 0.4719 L/S

Where:

CFM_S = The maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute.

hp = The maximum combined motor nameplate horsepower.

bhp = The maximum combined fan brake horsepower.

A = Sum of [PD X CFM_D/4131]

Where:

PD = Each applicable pressure drop adjustment from Table C403.8.1 (2) in. w.c.

CFM_D = The design airflow through each applicable device from Table C403.8.1(2) in cubic feet per minute.

C502.2.6 Revise section as follows:

C502.2.6 Light power and systems

New lighting systems that are installed as part of the addition shall comply with Section C405 and Section 502.2.6 as amended.

C502.2.6.1 Revise section as follows:

C502.2.6.1 Interior lighting power

The total interior lighting power for the addition shall comply with Section C405.3.2, where Table C405.3.2(1) is replaced with Table C502.2.6.1(1) and Table C405.3.2(2) is replaced with Table C502.2.6.1(2). The addition shall comply for the addition alone, or the existing building and the addition shall comply as a single building.

C502.2.6.1.1 Add section as follows:

C502.2.6.1.1 Occupant sensor controls. Occupant *sensor controls* shall be installed in accordance with C405.2.1. Occupant *sensor controls* shall also be installed in the following space types:

1. Corridor/transition areas
2. Dining areas

C502.2.6.1.2 Add section as follows:

C502.2.6.1.2 Occupant sensor control function for egress illumination

In new buildings, luminaires serving the exit access and providing means of egress illumination required by Section 1008.1 of the *International Building Code*, including luminaires that function as both normal and emergency means of egress illumination shall be controlled by a combination of listed emergency relay and occupancy sensors, or signal from another building control system that automatically reduces the lighting power by 50 percent when unoccupied for longer than 15 minutes.

Exceptions:

1. Means of egress illumination serving the exit access that does not exceed 0.02 watts per square foot of building area is exempt from this requirement.

2. Emergency lighting designated to meet Section 1008.3 of the *International Building Code.*

C502.2.6.2 Revise section as follows:

C502.2.6.2 Exterior lighting power

The total exterior lighting power for the addition shall comply with Section C405.4.2, where Table C405.4.2(2) is replaced with Table C502.2.6.2. The addition shall comply for the addition alone, or the existing building and the addition shall comply as a single building.

C502.2.6.1.1 Add section as follows:

C502.2.6.1.1 Exterior Lighting Controls

Exterior lighting systems shall be provided with controls that comply with Sections C405.2.6.1, C405.2.6.2, C405.2.6.4, C502.2.6.1, and C502.2.6.2. Decorative lighting systems shall comply with Sections C405.2.6.1, C405.2.6.2, and C405.2.6.4.

Exceptions:

1. Lighting for covered vehicle entrances and exits from buildings and parking structures where required for eye adaptation.
2. Lighting controlled from within dwelling units.

C502.2.6.1.2 Add section as follows:

C502.2.6.1.2 Exterior lighting setback. Lighting not controlled in accordance with Section C405.2.6.2 shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent by selectively switching off or dimming luminaires at one of the following times:

1. From not later than midnight to not earlier than 6 a.m.
2. From not later than one hour after business closing to not earlier than one hour before business opening.
3. During any time where activity has not been detected for 15 minutes or more.

C502.2.6.1.3 Add section as follows:

C502.2.6.1.3 Outdoor parking area lighting control

Outdoor parking area luminaires mounted 24’ or less above the ground shall be controlled to automatically reduce the power of each luminaire by a minimum of 50 percent when no activity has been detected for at least 15 minutes. No more than 1500 W of lighting power shall be controlled together.

Exception: Outdoor parking areas with less than 1,000 watts of lighting.

Table C502.2.6.1(1)
Interior Lighting Power Allowances: Building Area Method

BUILDING AREA TYPE	LPD (w/ft^2)
Automotive facility	0.64
Convention center	0.64
Courthouse	0.74
Dining: bar lounge/leisure	0.69
Dining: cafeteria/fast food	0.66
Dining: family	0.61
Dormitory [a, b]	0.52
Exercise center	0.65
Fire station [a]	0.50
Gymnasium	0.67
Health care clinic	0.68
Hospital [a]	0.86
Hotel/motel [a, b]	0.70
Library	0.78
Manufacturing facility	0.60
Motion picture theater	0.44
Multifamily [c]	0.45
Museum	0.55
Office	0.64
Parking garage	0.12
Penitentiary	0.67
Performing arts theater	0.85
Police station	0.66
Post office	0.62
Religious building	0.72
Retail	0.84
School/university	0.67
Sports arena	0.76
Town hall	0.69
Transportation	0.50

Table C502.2.6.1(1)
Interior Lighting Power Allowances: Building Area Method (continued)

BUILDING AREA TYPE	LPD (w/ft^2)
Warehouse	0.41
Workshop	0.83

a. Where sleeping units are excluded from lighting power calculations by application of Section R405.1, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.
b. Where dwelling units are excluded from lighting power calculations by application of R405.1, neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.
c. Dwelling units are excluded. Neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.

Table C502.2.6.1(2)
Interior Lighting Power Allowances: Space-by-Space Method

COMMON SPACE TYPES [a]	LPD (w/ft^2)
Atrium	
Less than 40 feet in height	The lower of 0.023 per foot in total height or 0.39
Greater than 40 feet in height	The lower of 0.40 + 0.02 per foot in total height or 0.60
Audience seating area	
In an auditorium	0.61
In a convention center	0.65
In a gymnasium	0.23
In a motion picture theater	0.27
In a penitentiary	0.28
In a performing arts theater	1.16
In a religious building	0.72
In a sports arena	0.33
Otherwise	0.23
Banking activity area	0.61
Breakroom (See Lounge/Breakroom)	
Classroom/lecture hall/training room	
In a penitentiary	0.89
Otherwise	0.71
Computer room	0.94
Conference/meeting/multipurpose room	0.93

Confinement cells	0.52
Copy/print room	0.31
Corridor	
In a facility for the visually impaired (and not used primarily by the staff) [b]	0.71
In a hospital	0.71
In a manufacturing facility	0.28
In a primary or secondary school (and not used primarily by the staff)	0.74
Otherwise	0.41
Courtroom	1.06
Dining area	
In bar/lounge or leisure dining	0.62
In cafeteria or fast food dining	0.40
In a facility for the visually impaired (and not used primarily by the staff) [b]	1.27
In family dining	0.54
In a penitentiary	0.42
Otherwise	0.43
Electrical/mechanical room	0.39
Emergency vehicle garage	0.41
Food preparation area	0.92
Guestroom [c, d]	0.41
Laboratory	
In or as a classroom	1.04
Otherwise	1.32
Laundry/washing area	0.43
Loading dock, interior	0.51
Lobby	
For an elevator	0.52
In a facility for the visually impaired (and not used primarily by the staff) [b]	0.51
In a hotel	0.68
In a motion picture theater	0.23
In a performing arts theater	0.82
Otherwise	0.84
Locker room	0.45
Lounge/breakroom	

In a healthcare facility	0.42
Otherwise	0.44
Office	
Enclosed	0.74 for less than 250 sf, 0.66 for greater than 250 sf
Open plan	0.61
Parking area, interior [i]	0.11
Pharmacy area	1.23
Restroom	
In a facility for the visually impaired (and not used primarily by the staff) [b]	0.81
Otherwise	0.63
Sales area	1.05
Seating area, general	0.38
Stairway (See space containing stairway)	
Stairwell	0.49
Storage room	0.43
Vehicular maintenance area	0.53
Workshop	1.09
BUILDING TYPE SPECIFIC SPACE TYPES [a]	
Automotive (See Vehicular Maintenance Area above)	
Convention Center—exhibit space	0.61
Dormitory—living quarters [c, d]	0.46
Facility for the visually impaired [b]	
In a chapel (and not used primarily by the staff)	0.70
In a recreation room (and not used primarily by the staff)	1.53
Fire Station—sleeping quarters [c]	0.19
Gymnasium/fitness center	
In an exercise area	0.50
In a playing area	0.75
Healthcare facility	
In an exam/treatment room	1.16
In an imaging room	0.94
In a medical supply room	0.54
In a nursery	0.92
In a nurse's station	0.75
In an operating room	1.87

In a patient room [c]	0.45
In a physical therapy room	0.84
In a recovery room	0.89
Library	
In a reading area	0.77
In the stacks	1.18
Manufacturing facility	
In a detailed manufacturing area	0.80
In an equipment room	0.61
In an extra-high-bay area (greater than 50' floor-to-ceiling height)	0.73
In a high-bay area (25-50' floor-to-ceiling height)	0.58
In a low-bay area (less than 25' floor-to- ceiling height)	0.61
Museum	
In a general exhibition area	0.31
In a restoration room	0.77
Performing arts theater—dressing room	0.35
Post Office—Sorting Area	0.66
Religious buildings	
In a fellowship hall	0.54
In a worship/pulpit/choir area	0.85
Retail facilities	
In a dressing/fitting room	0.49
In a mall concourse	0.79
Sports arena—playing area	
For a Class I facility [e]	2.26
For a Class II facility [f]	1.45
For a Class III facility [g,j]	1.08
For a Class IV facility [h,j]	0.72
Transportation facility	
In a baggage/carousel area	0.39
In an airport concourse	0.25
At a terminal ticket counter	0.48
Warehouse—storage area	
For medium to bulky, palletized items	0.27
For smaller, hand-carried items	0.65

In cases where both a common space type and a building area specific space are listed, the building area specific space type shall apply.

b. A 'Facility for the Visually Impaired' is a facility that is licensed or will be licensed by local or state authorities for senior long-term care, adult daycare, senior support or people with special visual needs.

Where sleeping units are excluded from lighting power calculations by application of Section R405.1, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.

d. Where dwelling units are excluded from lighting power calculations by application of Section R405.1, neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.

Class I facilities consist of Professional facilities; and Semi-professional, Collegiate, or Club facilities with seating for 5,000 or more spectators.

f. Class II facilities consist of Collegiate and Semi-professional facilities with seating for fewer than 5,000 spectators; Club facilities with seating for between 2,000 and 5,000 spectators; and Amateur League and High School facilities with seating for more than 2,000 spectators.

g. Class III facilities consist of Club, Amateur League, and High School facilities with seating for 2,000 or fewer spectators.

h. Class IV facilities consist of Elementary School and Recreational facilities, and Amateur League and High School facilities without provisions for spectators.

i. The wattage of lighting in daylight transition zones and ramps without parking is excluded.

j. Pool surfaces are excluded. Neither the surface area of the swimming or spa pool nor the wattage of the lighting serving them shall be counted.

Table C502.2.6.2
Lighting Power Allowances for Building Exteriors

	LIGHTING ZONES			
	Zone 1	**Zone 2**	**Zone 3**	**Zone 4**
Base Site Allowance	350 W	400 W	500 W	900 W
Uncovered Parking Areas				
Parking areas and drives	0.03 W/ft^2	0.04 W/ft^2	0.05 W/ft^2	0.05 W/ft^2
Building Grounds				
Walkways and ramps less than 10 feet wide	0.5 W/linear foot	0.5 W/linear foot	0.6 W/linear foot	0.7 W/linear foot
Walkways and ramps 10 feet wide or greater, plaza areas special feature areas	0.10 W/ft^2	0.10 W/ft^2	0.11 W/ft^2	0.14 W/ft^2

Dining areas	0.65 W/ft^2	0.65 W/ft^2	0.75 W/ft^2	0.95 W/ft^2
Stairways	0.6 W/ft^2	0.7 W/ft^2	0.7 W/ft^2	0.7 W/ft^2
Pedestrian tunnels	0.12 W/ft^2	0.12 W/ft^2	0.14 W/ft^2	0.21 W/ft^2
Landscaping	0.03 W/ft^2	0.04 W/ft^2	0.04 W/ft^2	0.04 W/ft^2
Building Entrances and Exits				
Pedestrian and vehicular entrances and exits	12.6 W/linear foot of opening width	12.6 W/linear foot of opening width	20 W/linear foot of opening width	20 W/linear foot of opening width
Entry canopies	0.20 W/ft^2	0.25 W/ft^2	0.4 W/ft^2	0.4 W/ft^2
Loading docks	0.35 W/ft^2	0.35 W/ft^2	0.35 W/ft^2	0.35 W/ft^2
Sales Canopies				
Free-standing and attached	0.04 W/ft^2	0.04 W/ft^2	0.6 W/ft^2	0.7 W/ft^2
Outdoor Sales				
Open areas (including vehicle sales lots)	0.02 W/ft^2	0.02 W/ft^2	0.35 W/ft^2	0.05 W/ft^2
Street frontage for vehicle sales lots in addition to “open area” allowance	No allowance	7 W/linear foot	7 W/linear foot	21 W/linear foot

For SI: 1 foot = 304.8 mm, 1 watt per square foot = 1 W/0.0929 m^2. W = watts

C502.2.8 Add section as follows:

C502.2.8 Power Conversion System

New traction elevators with a rise of 75 feet or more in new buildings shall have a power conversion system that complies with Sections 405.8.1.1.1 through 405.8.1.1.3.

C502.2.8.1 Motor. Induction motors with a Class IE2 efficiency ratings, as defined by IEC EN 60034-30, or alternative technologies, such as permanent magnet synchronous motors that have equal or better efficiency, shall be used.

C502.2.8.2 Transmission. Transmissions shall not reduce the efficiency of the combined motor/transmission below that shown for the Class IE2 motor for elevators with capacities below 4,000 lbs. Gearless machines shall be assumed to have a 100 percent transmission efficiency.

C502.2.8.3 Drive. Potential energy released during motion shall be recovered with a regenerative drive that supplies electrical energy to the building electrical system.

C502.2.9 Add section as follows:

C502.2.9 Commercial Kitchen Equipment

Commercial kitchen equipment shall comply with the minimum efficiency requirements of Tables C502.2.9(1) through table C502.2.9(5).

Table C502.2.9(1)
Minimum Efficiency Requirements: Commercial Fryers

	Heavy-Load Cooking Energy Efficiency	Idle Energy Rate	Test Procedure
Standard Open Deep-Fat Gas Fryers	≥ 50%	≤ 9,000 Btu/hr	ASTM Standard F1361-17
Standard Open Deep-Fat Electric Fryers	≥ 83%	≤ 800 watts	
Large Vat Open Deep-Fat Gas Fryers	≥ 50%	≤ 12,000 Btu/hr	ASTM Standard F2144-17
Large Vat Open Deep-Fat Electric Fryers	≥ 80%	≤ 1,100 watts	

Table C502.2.9(2)
Minimum Efficiency Requirements: Commercial Hot Food Holding Cabinets

Product Interior Volume (Cubic Feet)	Maximum Idle Energy Consumption Rate (Watts)	Test Procedure
0 < V < 13	≤ 21.5 V	ASTM Standard F2140-11
13 ≤ V < 28	≤ 2.0 V + 254.0	
28 ≤ V	≤ 3.8 V + 203.5	

Table C502.2.9(3)
Minimum Efficiency Requirements: Commercial Steam Cookers

Fuel Type	Pan Capacity	Cooking Energy Efficiency[a]	Idle Rate	Test Procedure
Electric Steam	3-pan	50%	400 watts	ASTM Standard F1484-18
	4-pan	50%	530 watts	
	5-pan	50%	670 watts	
	6-pan and larger	50%	800 watts	
Gas Steam	3-pan	38%	6,250 Btu/h	
	4-pan	38%	8,350 Btu/h	
	5-pan	38%	10,400 Btu/h	
	6-pan and larger	38%	12,500 Btu/h	

a. Cooking Energy Efficiency is based on heavy load (potato) cooking capacity

Table C502.2.9(4)
Minimum Efficiency Requirements:
Commercial Dishwashers

Machine Type	High Temp Efficiency Requirements		Low Temp Efficiency Requirements		Test Procedure
	Idle Energy Rate[a]	Water Consumption[b]	Idle Energy Rate[a]	Water Consumption[b]	
Under Counter	≤ 0.50 kW	≤ 0.86 GPR	≤ 0.50 kW	≤ 1.19 GPR	ASTM Standard F1696-18
Stationary Single Tank Door	≤ 0.70 kW	≤ 0.89 GPR	≤ 0.60 kW	≤ 1.18 GPR	
Pot, Pan, and Utensil	≤ 1.20 kW	≤ 0.58 GPSF	≤ 1.00 kW	≤ 0.58 GPSF	
Single Tank Conveyor	≤ 1.50 kW	≤ 0.70 GPR	≤ 1.50 kW	≤ 0.79 GPR	
Multiple Tank Conveyor	≤ 2.25 kW	≤ 0.54 GPR	≤ 2.00 kW	≤ 0.54 GPR	ASTM Standard F1920-15
Single Tank Flight Type	Reported	GPH ≤ 2.975x + 55.00	Reported	GPH ≤ 2.975x + 55.00	
Multiple Tank Flight Type	Reported	GPH ≤ 4.96x + 17.00	Reported	GPH ≤ 4.96x + 17.00	

a. Idle results shall be measured with the door closed and represent the total idle energy consumed by the machine including all tank heater(s) and controls. Booster heater (internal or external) energy consumption should not be part of this measurement unless it cannot be separately monitored per US EPA Energy Star Commercial Dishwasher Specification Version 2.0.

b. GPR = gallons per rack; GPSF = gallons per square foot of rack; GPH = gallons per hour; x = sf of conveyor belt (i.e., W*L)/min (maximum conveyor speed).

Table C502.2.9(5)
Minimum Efficiency Requirements: Commercial Ovens

Fuel Type	Classification	Idle Rate	Cooking-Energy Efficiency, %	Test Procedure
Convection Ovens				
Gas	Full-Size	≤ 12,000 Btu/h	≥ 46	ASTM F1496 - 13
Electric	Half-Size	≤ 1.0 Btu/h	≥ 71	
	Full-Size	≤ 1.60 Btu/h		
Combination Ovens				
Gas	Steam Mode	≤ 200P[a]+6,511 Btu/h	≥ 41	ASTM F2861 - 17
	Convection Mode	≤ 150P[a]+5,425 Btu/h	≥ 56	
Electric	Steam Mode	≤ 0.133P[a]+0.6400 kW	≥ 55	
	Convection Mode	≤ 0.080P[a]+0.4989 kW	≥ 76	
Rack Ovens				
Gas	Single	≤ 25,000 Btu/h	≥ 48	ASTM F2093 - 18
	Double	≤ 30,000 Btu/h	≥ 52	

1. P = Pan Capacity: The number of steam table pans the combination oven is able to accommodate as per the ASTM F – 1495 – 05 standard specification.

C502.2.10 Add section as follows:

C502.2.10 Whole building energy monitoring.

Measurement devices shall be installed to individually monitor energy use of each of the following types of energy supplied by a utility, energy provider, or plant that is not within the building:

a. Natural gas
b. Fuel oil
c. Propane
d. Steam
e. Chilled Water
f. Hot Water

Exceptions:

1. Buildings less than 25,000 square feet (2,325 m^2).
2. Group R buildings with less than 10,000 square feet of common area (930 m^2).
3. Fuel use for on-site emergency equipment.

C502.2.11 Add section as follows:

C502.2.11 Whole building energy monitoring.

Each building shall have a measurement device capable of recording electrical energy use every 60 minutes and the capability to report use on an hourly, daily, monthly, and annual basis. The measurement device shall be capable of retaining the recorded data for 36 months.

Exceptions:

ii. Buildings less than 25,000 square feet (2,325 m^2).
iii. *Group R* buildings with less than 10,000 square feet of common area (930 m^2).
iv. Fuel use for on-site emergency equipment.

C502.2.12 Add section as follows:

C502.2.12 Additional Energy Efficiency Credits

Additions shall achieve a total of 10 credits from Table C502.2.12. *Alterations* to the existing building that are not part of the *addition*, but permitted with the *addition*, may be used to achieve the required credits.

Exceptions:

1. Additions less than 1,000 ft^2 and less than 50% of existing floor area.

2. *Additions* that do not include the addition or replacement of equipment covered in Section C403.3 or C404.2 that achieve a total of 5 Credits.
3. *Additions* that do not contain *conditioned space* that achieve a total of 5 credits.
4. Equipment buildings as defined in C402.1.2, that achieve a total of 7 credits.
5. *Buildings* in Residential Group R and Institutional Groups I in climate zones 3C, 4B, 4C, 5C that achieve a total of 7 credits
6. *Buildings* in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, High-Hazard Group H
7. Low-energy buildings as defined in C402.1.1
8. Where the *addition* alone or the existing building and *addition* together comply with Section C407

Table C502.2.12 Additional Energy Efficiency Credits

	Group B	Group R & I	Group E	Group M	Other[a]
C502.2.12.1.1: 5% Heating	1	1	1	2	1
C502.2.12.1.2: 5% Cooling	2	1	1	1	1
C502.2.12.1.3: 10% Heating	2	2	3	3	3
C502.2.12.1.4: 10% Cooling	4	1	2	2	2
C502.2.12.2: 10% LPA	7	2	8	12	7
C502.2.12.3: Digital Lt Ctrl	2	NA	2	NA	2
C502.2.12.4: Renewable	9	7	6	7	7
C502.2.12.5: DOAS	5	8	NA	2	5
C502.2.12.6: SWH HR	NA	14	1[b]	NA	14
C502.2.12.7: SWH HP	NA	9	2[b]	NA	9
C502.2.12.8: 85% UA	10	5	1	NA	5
C502.2.12.9: Low Leak	11	4	2	4	5
C502.2.12.10: Efficient Kitchen Equipment	1	9	1	3	6

a. Other occupancy groups include all Groups except for Groups B, R, I, E, and M

b. for schools with full-service kitchens or showers

C502.1.12.1 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through C403.3.2(9) and *variable refrigerant flow* systems listed in the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 in accordance with Sections C502.1.12.1.1, C502.1.12.1.2, C502.1.12.1.3 or C502.1.12.1.4. Equipment shall also meet applicable requirements of Section C403. Energy efficiency credits

for heating shall be selected from C502.1.12.1.1 or C502.1.12.1.3 and energy efficiency credits for cooling shall be selected from C502.1.12.1.2 or C502.1.12.1.4. Selected credits shall include a heating or cooling energy efficiency credit or both. Equipment not listed in Tables C403.3.2(1) through C403.3.2(9) and *variable refrigerant flow* systems not listed in the energy efficiency provisions of ASHRAE/IESNA 90.1 shall be limited to 10 percent of the total building system capacity for heating equipment where selecting Section C502.1.12.1.1 or C502.1.12.1.3 and cooling equipment where selecting Section C502.1.12.1.2 or C502.1.12.1.4.

C502.1.12.1.1 Five percent heating efficiency improvement. Equipment shall exceed the minimum heating efficiency requirements by 5 percent.

C502.1.12.1.2 Five percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C502.1.12.1.3 Ten percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 10 percent.

C502.1.12.1.4 Ten percent cooling efficiency improvement. Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C502.1.12.2 Reduced lighting power The total connected interior lighting power calculated in accordance with Section C405.3.1 shall be less than 90% of the total lighting power allowance calculated in accordance with Section C502.2.6.1. The total connected exterior lighting power calculated in accordance with Section C405.4.1 shall be less than 90% of the total lighting power allowance calculated in accordance with Section C502.2.6.2.

C502.1.12.3 Enhanced digital lighting controls

Interior lighting in the building shall have the following enhanced lighting controls that shall be located, scheduled and operated in accordance with Section C405.2.2.

1. Luminaires shall be configured for continuous dimming.
2. Luminaires shall be addressed individually. Where individual addressability is not available for the luminaire class type, a controlled group of not more than four luminaries shall be allowed.
3. Not more than eight luminaires shall be controlled together in a daylight zone.
4. Fixtures shall be controlled through a digital control system that includes the following function:

    4.1 Control reconfiguration based on digital addressability.

    4.2 Load shedding.

    4.3 Occupancy sensors shall be capable of being reconfigured through the digital control system.

5 Construction documents shall include submittal of a Sequence of Operations, including a specification outlining each of the functions in Item 4.

6 Functional testing of lighting controls shall comply with Section C408.

C502.1.12.4 On-site renewable energy. Buildings shall comply with Section C502.1.12.1.1 or C502.1.12.2.

C502.1.12.1.1 Basic renewable credit. The total minimum ratings of on-site renewable energy systems not including systems used for credits under Sections C406.7.2, shall be one of the following:1. Not less than 0.86 Btu/h per square foot (2.7 W/m) or 0.25 watts per square foot (2.7 W/m) of conditioned floorarea.2. Not less than 2 percent of the annual energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

C502.1.12.1.2 Enhanced Renewable Credits. Where the total minimum ratings of on-site renewable energy systems exceeds the rating in C406 .5.1(1), additional energy efficiency credits shall be determined based on Equation 4-13, rounded to the nearest whole number.

$AEEC_{RRa} = AEEC_{2.5} \times RR_a/RR^1$ (Equation 4-13)

Where:

$AEEC_{RRa}$ = C406 .5.2 additional energy efficiency credits

RR_a = actual total minimum ratings of on-site renewable energy systems in Btu/h, watts per square foot or W/m)

RR_1 =minimum ratings of on-site renewable energy systems required by C406.5.1(1) in Btu/h, watts per square foot or W/m)

$AEEC_{2.5}$ = C406 .5.1 credits from Tables C406 .1(1) through C406.1(5)

C502.1.12.5 Reduced energy use in service water heating. Buildings shall comply with Section C502.1.12.5.1 and Section C502.1.12.5.2, C502.1.12.5.3 or C502.1.12.5.4.

C502.1.12.5.1 Building Type To qualify for this credit, the building shall contain one of the following use groups and the additional energy efficiency credit shall be prorated by conditioned floor area of the portion of the building comprised of the following use groups:

2. Group R-1: Boarding houses, hotels or motels.
3. Group I-2: Hospitals, psychiatric hospitals and nursing homes.
4. Group A-2: Restaurants and banquet halls or buildings containing food preparation areas.
5. Group F: Laundries
6. Group R-2.
7. Group A-3: Health clubs and spas
8. Group E: Schools with full-service kitchens or locker rooms with showers
9. Buildings showing a service hot water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in Section C407.

C502.1.12.5.2 Recovered or renewable water heating The building service water-heating system shall have one or more of the following that are sized to provide not less than 30 percent of the building's annual hot water requirements, or sized to provide 70 percent of the building's annual hot water requirements if the building is required to comply with Section C403.9.5:1.

1. Waste heat recovery from service hot water, heat-recovery chillers, building equipment, or process equipment.
2. On-site renewable energy water-heating systems.

C502.1.12.5.3 Efficient fossil fuel water heater. The combined input-capacity-weighted-average equipment rating of all fossil fuel water heating equipment in the

building shall be not less than 95% Et or 0.95 EF. This option shall receive only half the listed credits for buildings required to comply with C404.2.1.

C502.1.12.5.4 Heat pump water heater Where electric resistance water heaters are allowed, all service hot water system heating requirements shall be met using heat pump technology with a combined input-capacity-weighted-average EF of 3.0. Air-source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.

C503.1 Revise section as follows:

C503.1 General

Alterations to any building or structure shall comply with the requirements of Section C503 and the code for new construction. Alterations shall be such that the existing building or structure is not less conforming to the provisions of this code than the existing building or structure was prior to the alteration. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Exception: The following alterations need not comply with the requirements for new construction, provided that the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Surface-applied window film installed on existing single-pane fenestration assemblies reducing solar heat gain, provided that the code does not require the glazing or fenestration to be replaced.
3. Construction where the existing roof, wall or floor cavity is not exposed.
4. Roof recover.
5. Air barriers shall not be required for roof recover and roof replacement where the alterations or renovations to the building do not include alterations, renovations or repairs to the remainder of the building envelope.

C503.1.1 *Extensive alterations* shall comply with Section C506.

C503.3 Revise section as follows:

C503.3 Building envelope

New building envelope assemblies that are part of the alteration shall comply with Sections C402.1 through C402.5, where Table C402.1.3 is replaced with Table C503.3.1, Table C402.1.4 is replaced with Table C503.3.2, and Table C402.4 is replaced with Table C502.1.3.

Table C503.3.1

Opaque Thermal Envelope Insulation Component Minimum Requirements, R-value Method[a,h]

	All other	Group R
Roofs		
Insulation Entirely above roof deck	R-33ci	R-33ci
Metal buildings[b]	R-19 + R-11 LS	R-19 + R-11 LS

Attic and other	R-53	R-53
Ceilings without attic spaces	R-30	R-30
Walls, above grade		
Mass[f]	R-13.3ci	R-15.2ci
Metal building	R-13+ R-19.5ci	R-13+ R-19.5ci
Metal framed	R-15	R-15
Wood framed and other, 2x4 nominal framing depth	R-13	R-13
Wood framed and other, 2x6 nominal framing depth	R-20	or R-20
Walls, below grade		
Below-grade wall[c]	R-7.5ci	R-10ci
Floors		
Mass[d]	R-15ci	R-16.7ci
Joist/framing	R-30[e]	R-30[e]
Slab-on-grade floors		
Unheated slabs	R-10 for 24" below	R-10 for 24" below
Heated slabs[g]	R-15 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab
Opaque doors		
Non-Swinging	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m2, 1 pound per cubic foot = 16 kg/m3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.
c. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. Steel floor joist systems shall be insulated to R-38.
f. "Mass walls" shall be in accordance with Section C402.2.2.
g. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
h. Not applicable to garage doors. See Table C402.1.4.

Table C503.3.2

Opaque Thermal Envelope Assembly Maximum Requirements: U-Factor Method

	All other	Group R
Roofs		
Insulation Entirely above roof deck	U-0.030	U-0.030
Metal buildings	U-0.035	U-0.035
Attic and other	U-0.020	U-0.020
Ceilings without attic spaces	U-0.033	U-0.033
Walls		
Mass[e]	U-0.086	U-0.076
Metal building	U-0.048	U-0.048
Metal framed	U-0.052	U-0.052
Wood framed and other[c], 2x4 nominal depth	U-0.084	U-0.084
Wood framed and other[c], 2x6 nominal depth	U-0.060	U-0.060
Below-grade wall[c]	C-0.119	C-0.092
Floors		
Mass[d]	U-0.057	U-0.051
Joist/framing	U-0.033	U-0.033
Slab-on-grade floors		
Unheated slabs	F-0.52	F-0.51
Heated slabs	F-0.63	F-0.63
Opaque doors		
Swinging	U-0.37	U-0.37
Garage door <14% glazing	U-0.31	U-0.31

a. For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m2, 1 pound per cubic foot = 16 kg/m3. ci = Continuous insulation, NR = No Requirement, LS = Liner System.

b. Where assembly U-factors, C-factors, and F-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.

c. Where U-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The R-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.

d. Where heated slabs are below grade, below-grade walls shall comply with the U-factor requirements for above-grade mass walls.

e. “Mass floors” shall be in accordance with Section C402.2.3. “Mass walls” shall be in accordance with Section C402.2.2.

C503.6.1 Add subsection as follows:

C503.6.1 Lighting in existing fixtures

All existing permanent fixtures shall contain only high efficacy lamps.

Section C505 Change of occupancy or use

C505.1 Revise section as follows:

C505.1 General

Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with Section 502. Where the use in a space changes from one use in Table C502.2.6.1(1) or C502.2.6.1(2) to another use in Table C502.2.6.1(1) or C502.2.6.1(2), the installed lighting wattage shall comply with Section C502.2.6.1. Where the space undergoing a change in occupancy or use is in a building with a fenestration area that exceeds the limitations of Section C402.4.1, the space is exempt from Section C402.4.1 provided that there is not an increase in fenestration area.

C506 Add section as follows:

C506 Extensive alterations

C506.1 General *Extensive alterations* to existing buildings shall comply with Section C506.1.1 or C506.1.2 and C506.2.

C506.1 Prescriptive The extensive alteration shall meet the requirements for additions in Section C502 as applicable to the components being altered.

C506.2 Performance The extensive alteration shall demonstrate energy use per square foot at least 10% below the energy requirements of ANSI/ASHRAE/IESNA 90.1 2013 Appendix G. Extensive alterations following this compliance path shall earn 10 Energy Efficiency Credits according to section C502.2.12. The selected Energy Efficiency Credit options shall be included in calculating the baseline building performance value.

C506.2 Lighting in existing fixtures

All existing permanent fixtures shall contain only high efficacy lamps.